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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**
AUGUST 1949EROSION CONTROL PRACTICES DIVISION

Storm of June 29 Causing Excessive Erosion and Crop Damage Emphasized Importance of Good Row Layout on Tobacco Land - T. L. Copley, Raleigh, North Carolina.-"A rain of 3.40 inches occurred at the Station on June 29, with much more falling in nearby areas and causing serious damage to much of the crop land. Drowned tobacco was also prevalent in many fields. A trip through the storm area was made the following day to observe the damage and to study the effects of various farm practices. Messrs. E. B. Garrett, State Conservationist, and W. W. Stevens, State Soil Scientist, accompanied Luke A. Forrest and the Project Supervisor on this trip. The worst damage was found to be in the vicinity of Eagle Rock, a community approximately 3 miles west of Wendell, North Carolina, and 3 miles east of the Station. Tobacco fields had been badly gullied in some places, with drowned tobacco in others. The situation was very much aggravated by the up-and-down hill system of row layout, which caused broken terraces at certain points and poor row drainage at others. We then observed the tobacco fields on the Experiment Station farm where we have properly laid out rows. Here each row was draining properly and carrying its own water as a little terrace, and relatively little erosion was observed. It emphasized the importance of good row layout in this tobacco area."

Mulched Middles in Tobacco Rows Look Promising - T. L. Copley.-"A new tobacco rotation experiment includes one treatment in which the winter cover of rye is left undisturbed in a 12 inch balk along the row middle until the last cultivation. This trashy balk is then plowed out and scattered in the row middles with an appreciable amount of mulch cover. Although the summers data have not been completed, there was a marked reduction noted in runoff and soil loss for the first few rains after the last plowing. These data will be reported as soon as tabulation is completed."

Corn Ridging Study - T. L. Copley.-"While the practice of growing tobacco on ridged rows has been generally recommended, there is no experimental data to show the merit of such a practice. The fact that ridged rows, properly

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

laid out, may be used as an effective conservation measure makes it desirable to know what effect ridging has on crop growth. Results of studies made by C. S. Britt at the Beltsville Station show that yields of corn were consistently higher when planted on ridged rows than when planted flat. A tentative study of this practice with both corn and tobacco is being started at this Station. Observations to date show that corn planted on ridges has made more rapid growth than when planted flat. A formal work plan of this study is being prepared."

Erosion Hazard on Bare Soil - T. N. Jones, State College, Miss.-

"Rainfall for the month of July at State College, Mississippi was 3.68 inches. The 50-year average rainfall for July at this location is 3.70 inches. Rain was recorded twelve days during the month. Thus the total rainfall for first seven months was 44.30 inches.

"The temperature stayed in the 90 degree zone. Temperature of 90 degrees or above was recorded 22 days during the month. The minimum temperature recorded was 70 degrees.

Runoff and Soil Loss on Bare Plot - July 1949 - Approximately 9 Percent Slope

July	Rainfall	Percent Runoff	Soil Loss Lbs/Acre
1	.05		
3	.03		
7	.23		
12	1.02	62	5240
16	.12)		
17	.44)	37	1308
22	.01)		
23	.05)-	18	464
24	.57)		
27	.07)		
28	1.04)-	58	5072
29	.05)		
Total	3.68		12084

"The difference in height and color of cotton on plots with and without winter cover crop continue to be outstanding. The yield in past years has proven that winter cover crop pays both from money return and from soil saved.

"A comparison between sod plot and bare plot for seven years shows that 747 tons of soil were washed away from bare plot as compared to no loss from sod plot."

Stubble Mulch Tillage Machine Study by Manufacturing Company -

C. J. Whitfield.-"Stubble mulch studies on the Amarillo Experiment Station during the past 8 years, as previously reported, have shown excellent results in favor of the stubble mulch type of tillage. Considerable interest has developed in this territory by farmers who would like to try stubble mulch farming, but have been unable to find a machine on the market that would do a satisfactory job.

"In June of this year, the Dempster Mill Manufacturing Company sent one of their representatives to the station with one of their sweep machines for trial on stubble mulch tillage. This machine is so constructed that five 30-inch sweeps, heavy chisels, grain drill, and lister and planted can be mounted on the same frame. After wheat harvest, this machine equipped with the 30-inch sweeps was used on fields with heavy wheat straw residue ranging from 3,000 to 6,000 pounds per acre. The ground was hard and dry, and even with the addition of considerable weight, the machine would not plow. The rolling coulters were too small and would drag trash, which kept the machine from going into the ground. The hitch was of a flexible nature and too short, which allowed the rear sweeps to come out of the ground. Some trouble was also encountered with the sweep standards bending sideways. The machine has one power lift located on one side which did not lift very satisfactorily, and had a tendency to spring the axle on the opposite side.

"Representatives from the Dempster Manufacturing Company visited the station and showed an interest in making changes necessary for satisfactory operation. The men returned to the factory and made the suggested changes. They now have the machine on the station and have spent several days in the field trying it out under various field conditions. From the trials to date, the indications are that the machine will do a satisfactory job of stubble mulch tillage.

"The grain drill attachment was also used in heavy wheat stubble and seemed to work very well. The shovels are 4 inches wide on 12-inch centers, and will penetrate rather hard ground. There is sufficient clearance for most trash conditions."

Effects of Winter Protection in Maryland, 1948-49 - C. S. Slater, Beltsville, Maryland.-"Last fall Henry Hopp established winter protection plots at 10 widely separated locations in Maryland, from Oakland to Salisbury, and representative of markedly different conditions of soil, cropping and climate. This spring Henry and I sampled these plots and obtained the following data. Averages only are given.

Treatment	Earthworms		Volume of	Infiltration	Water-stable
	Per sq. ft.		Large Pores	In. Per Min.	Aggregation
	No.	Wt.-gms	%		%
None	20.7	3.10	5.9	.07	65.6
Alfalfa hay mulch	58.3	11.19	9.0	.17	68.7
Alfalfa hay mulch, fertilized	74.2	14.07	8.5	.22	71.4
Straw mulch	39.9	6.80	7.9	.12	68.8
Straw mulch, fertilized	35.2	6.61	7.4	.10	65.5

"The averages present the picture that characterized most of the locations. On all the soils mulching increased the earthworm population. Earthworm weights and numbers appear to be related directly to volumes of large pores and infiltration rates. On sandy soils the volume of large pores and infiltration rates were affected least by mulching and showed no appreciable

differences. Mulching with alfalfa caused a slight increase in aggregation, but the total results on aggregation are somewhat disappointing. Under the mild conditions that prevailed during the winter of 1948-49, it appears that the effects of winter protection on aggregation were not marked. This feature is common to all similar comparisons we have made this year, in contrast to the effects of protection during prior winters when mulching promoted or maintained a relatively high state of water stability.

Effect of Earthworms on the Growth of Locust Seedlings - C. S. Slater.-

"This is the report of a demonstration, not a replicated experiment. Locust seeds were planted June 15 in percolator cones in compacted Christiana silt loam to which fertilizer and organic matter had been added. One month before the planting twelve earthworms were placed in one of the containers. This gave the earthworms time to work the soil. Conditions for the soil in the two containers were identical otherwise. The following data tell the story.

Volume weight of compacted soil	1.7 gms./cu.cm.
Rate of fertilization, 5-10-5	1000 lbs/acre
Organic matter addition	3000 lbs/acre
Height of locust Aug. 26, with worms	49 Cm.
without worms	42 Cm.
Weight of locust Aug. 26, with worms	18 gms.
without worms	13 gms.

Effect of Wetting and Drying on the Water-Stability of Soil - Slater.-"Although it seems obvious that some degree of moistening must accompany the formation of soil aggregates, simple wetting and drying tends to destroy the water-stability of the aggregates already present in the soil. This is indicated by the following data on water-stability.

	Water-Stability of Soils From							
	Holgate, Ohio		Wooster, Ohio		College Pk., Md.		All three Soils	
Quality of soils ^{1/}	Poor %	Good %	Poor %	Good %	Poor %	Good %	Ave. %	Cor. Ave. ^{2/} %
Original soils	55.3	83.0	37.4	65.9	39.7	55.5	56.1	56.1
Wetted to low moisture and dried	44.9	76.8	29.0	66.8	36.8	52.8	51.2	55.4
Wetted to medium moisture & dried	36.8	71.0	22.2	60.4	25.0	49.9	44.2	53.5
Wetted to high moisture & dried	29.1	62.4	17.0	58.3	19.3	42.3	37.7	45.2

^{1/} These soils and the conditions of analysis have been described in "The Action of Frost on the Water-stability of Soils" by C. S. Slater and Henry Hopp, J. Agric. Res. 78: 341-346, May 15, 1949.

2/ Some consolidation of the fines in the original soil occurs when it is wetted and dried. Consequently, the 3-5 mm. fractions, used for analysis and from the wetted samples, are not strictly comparable to those of the original soils. For this reason, the effect of wetting and drying was omitted in the formal publication. An adjustment has been made in the corrected average for the decrease in the amount of fines that occurred on wetting. The percentage of material retained on a 2 mm. sieve was 32.6, 35.3, 39.5 and 39.1 for the original and the low medium and high moisture soils, respectively."

Stability of Soil Aggregates - Natural, Artificial Earthworm Casts - Richard M. Smith, Rio Piedras, Puerto Rico.-"Mr. Cernuda has summarized some of his soil aggregate stability testing. He has accumulated conclusive evidence that with all the soils studies so far the naturally occurring aggregates are more stable than any artificial balls or lumps that we have been able to prepare after puddling the soil. This is true regardless of whether the artificial aggregates are made from earthworm casts or from other natural aggregates. For example, with Catalina clay surface soil from Las Ochenta:

cc of Water to Destroy a 1-gram Aggregate at 1 Drop per Second				
Natural		Artificially-made from		
Fragments	Worm Casts	Fragments	Worm Casts	
No. 1	150 ✓	150 ✓	6	6
2	150 ✓	150 ✓	5	5
3	150 ✓	150 ✓	5	4
4	160	150 ✓	4	4
5			7	

"In the case of certain soils which do not have stable fragments, it has been found that worm casts are more stable:

cc to Destroy 1 gram Aggregates Descalabrado Clay Surface Aggregates			
Natural		Artificially-made from	
Fragments	Worm Casts	Fragments	Worm Casts
3	100 ✓	All slaked and fell thru screen without any water drops.	
8	100 ✓		
3	100 ✓		
3	100 ✓		
4	100 ✓		

Cialites Clay Surface Aggregates
All Naturally Occurring

1 Gram		1.5 Gram	
Fragments	Worm Casts	Fragments	Worm Casts
1	19	27	28
2	10	29	8
3	30	80	48
4	26	70	15
5	32	60	28

"A test of alternate wetting and drying of a Catalina clay sample indicates that this is not a constructive process with artificial aggregates from this soil and is definitely destructive of natural fragments:

cc to Destroy 1 Gram Aggregates					
	Artificially-made			Natural	
	Air Dry	Oven Dry	Wet & Dried 6 times	Air-Dry	Wet & Dried 6 times
1	4	3	3	100 /	13
2	7	4	4	100 /	25
3	4	3	3	100 /	5
4	5	4	4	100 /	7
5	8		3	100 /	5
			3		

"With a Cialitos silty clay soil profile it is clear that aggregate stability is limited to the upper part of the soil profile:

Sample Depth	cc to Destroy 1 gram Aggregates			
	1	2	3	4
0-8"	100 /,	100 /,	100 /	26
8-18"	2,	11,	84	
18-30"	0,	0,	0,	0 -slake completely
below 30"	0,	0,	0,	0 -slake completely and more rapidly than above.

"Various organic solvents have been used in an effort to destroy the natural stability of earthworm casts or natural fragments. These include benzene, toluene, xylene, alcohol, ether, and others. So far, none of these have shown any definite effect where they were allowed to evaporate before stability tests were carried out. This was true whether the casts were thoroughly leached with or were merely soaked in the solvent. However, when benzene, xylene, or toluene are applied to worm casts, with no time for evaporation before stability testing, the outer layer of the casts invariably slake and disintegrate in water. This behavior appears to be related to the physical entrapment and expulsion of the solvents by water entering the soil pores rather than to any chemical effect. It may be dependent upon a certain pore size distribution."

Inches of Water in Six Feet of Soil as Influenced by Different Fallow Practices - Hugh C. McKay, St. Anthony, Idaho.-"The time of plowing down the alfalfa and grass sods in the rotation plots has a marked effect on the yield of the first crop of wheat. The amount of moisture is determined by the date of plowing which is later reflected in the yield. The inches of water in the first six feet of soil is given in the following table:

Inches of Water in Six Feet of Soil

Treatment	Inches of Water
Sweet clover plowed down at 16-18 inch height	13.11
Sweet clover and grass plowed down at 16-18 inch height	13.16
Grass alone fall plowed before fallow year	16.60
Alfalfa and grass fall plowed before fallow year	16.86
Alfalfa fall plowed before fallow	16.86
Check Plot	14.64

"The sweet clover and sweet clover and grass was plowed as a green manure in the spring when it had reached a height of from 16-18 inches. This leaves about 1 inch less water in the first six feet of soil than in the straight fallow. If the sweet clover is allowed to grow to a height of 36 to 40 inches it reduces the subsoil moisture down to about 7 inches of water.

"Fall plowing the grass, alfalfa and grass and alfalfa plots makes a much better fallow and will increase the water content over two inches in the first six feet of soil as compared to the check. These rotations have over three inches more water than the sweet clover and grass and sweet clover plots which gives them a decided advantage on the first crops of wheat following."

Soil Moisture Under Terrace Channels and Under Inter-Terrace Areas - F. W. Schaller, Ames, Iowa.—"Soil moisture samples were taken at the Western Iowa Experimental Farm under first, second and third year brome-alfalfa pastures and under first-year corn following brome-alfalfa. The samples were taken at one-foot intervals down to a depth of eight feet. They were taken from terraced fields and represent areas between terraces and in the terrace channels. The soil moisture percentages are presented in the attached table. From the samples taken halfway between terraces the moisture content was found to be below the theoretical wilting point in all cases. Under corn moisture was somewhat higher in the upper three feet of soil than under alfalfa. However, there was no buildup of subsoil moisture below three feet under corn during the past months. The percentage of moisture was almost twice as high in the terrace channels as it was halfway between the terraces. Moisture was lowest under second year alfalfa. This may be due at least in part to the fact that the percentage of alfalfa in the stand was highest on this field.

Percentage Soil Moisture, Ida Silt. Loam, Western Iowa Experimental Farm. Sampled August 5, 1949*.

Depth Sampled (Ft.)	Location of Sample and Crop Grown							
	Halfway Between Terraces				Terrace Channels			
	Alfalfa-Brome Pasture		Corn**		Alfalfa-Brome Pasture		Corn**	
	1st Yr.	2nd yr.	3rd yr.	1st yr.	1st yr.	2nd yr.	3rd yr.	1st yr.
0-1	10.1	10.8	11.9	12.0	18.1	15.3	18.6	19.7
1-2	10.2	9.3	8.5	12.4	19.0	15.2	19.7	20.3
2-3	10.4	9.2	7.9	12.1	19.0	14.0	19.2	20.7
3-4	10.8	8.8	7.9	10.3	19.8	13.8	18.3	20.6
4-5	10.2	9.4	8.6	9.7	18.5	13.5	16.3	21.1
5-6	9.2	9.8	8.5	9.0	18.2	13.4	16.3	19.9
6-7	10.4	9.2	8.3	9.0	19.2	13.5	17.6	20.3
7-8	9.4	9.6	9.3	9.2	19.1	13.6	17.9	20.7

* Field capacity and wilting point 22.0 and 12.5% respectively, with some variation from these figures for different depths in the soil profile.

** Corn followed 2 years of brome-alfalfa."

Influence of Soil Physical Condition on Potato Yield - O. R.

Neal, New Brunswick.-"In 1946 a small pasture area on a farm near Freehold was added to an adjoining cultivated field. The pasture area had been in grass and some clover for at least 15 to 20 years. Treatment prior to that is not known but the soil conditions more or less approximated virgin conditions as far as cultivation was concerned. The remainder of the field had been under intensive cultivation and had been in potatoes for the past 10 years. Since 1946 the two areas have been cropped to potatoes annually. In 1947 yields were measured and penetrometer studies were made on the two areas. The yield from the sod area under the favorable growing conditions of the 1947 season was about 10% higher than that under continuous cultivation. The penetrometer records indicated compaction of the soil below plow depth on the continuously cultivated area. The relative force required to move a probe through the soil on the two areas is shown in the following table.

Force Recorded by Penetrometer

Depth Below Surface	Continuous Potatoes	Former Sod Area
Inches	Pounds	Pounds
10	180	93
11	210	72
12	204	73
13	156	60

"During the present season rainfall was quite deficient. The 1949 potato yield from these same areas was 276 bushels per acre from the former sod area and 203 bushels from the continuously cultivated area. The improved physical condition of the soil on the former sod area appears to have been highly beneficial during this drought year.

"It is not to be concluded, of course, that a desirable soil management system for potatoes consists of 20 years resting in sod followed by 20 years of cultivation. However, the principle of improving physical conditions of the soil by rotating cultivated crops with sod crops seems to be supported by these data."

Pasture Irrigation Yields - John Lamb, Jr., Ithaca, New York.-

"Pasture growth following the second application of fertilizer on June 13 was sampled July 13 with the following results:

Fertilizer applied June 13	Yields - oven dried		Increase for supplemental water added
	Tons per acre		
	Irrigated	Not Irrigated	
None	0.43	0.11	0.32
250 lbs. of 10-10-10	0.54	0.11	0.43
335 lbs. of 10-10-10	0.62	0.06	0.56
250 lbs. of 0-20-20	0.46	0.12	0.34
125 lbs. of 20-0-0	0.60	0.10	0.50
Rainfall for the period			1.69 inches
Effective water added by irrigation (estimate)			<u>3.67</u> inches
Total water on irrigated plots			5.36 inches

"All plots not irrigated were short and brown. There was some indication of fertilizer damage with the higher rate. Orchard grass would probably produce much higher yields in hot weather than the timothy blue grass. (E. A. Engdahl)."

A Small Rain Can Cause Runoff - G. R. Free.-"Hugh Wilson and Gere Kruse were at the Marcellus station on July 28 taking movies, and, during the afternoon, a thunderstorm formed in the west and approached the station. The camera was set up in the field to get some 'shots' of runoff from up and down hill corn rows if it occurred. The soil was very dry and it could be expected that considerable rain would be necessary to cause runoff even though the rows were up and down hill on an 8% slope. The storm lasted only six minutes during which 0.22" of rain fell. Runoff did start, and, although the amount of water lost was small, it was a striking example of the value of the surface storage afforded by contour and across-the-slope planting. This has certainly been a year when loss of water by runoff could be expected to mean lower yields."

Effect of Crop Residues and Tillage Practices, etc. - North Montana Branch Station, Havre, Montana - T. S. Aasheim, Havre, Montana.-
 "Quadrats were cut for yield determinations of straw and grain but have not yet been threshed. Combining of plots was completed about the middle of the month. Yields per acre on fallow by treatment as determined from total plot yields are presented in the following table:

Implements Used in Rotation

Fallow Method	Bushels per acre	
	Stubble burned	Stubble not burned
Subtilled	6.6	7.7
Onewayed	8.4	8.7
Plowed	6.7	6.6
Average	7.2	7.7
Average all plots where tillage method has been rotated		7.5 bushels

Same Implements Used Continuously

Fallow Method	Bushels per acre	
	Stubble burned	Stubble not burned
Subtilled	5.8	6.9
Onewayed	7.4	7.2
Plowed	6.9	7.5
Average	6.7	7.2
Average all plots where same type of cultivation has been used continuously		6.9 bushels

"All plots in fallow were cultivated once during the month. This was the fourth cultivation for all plots except the unburned sub-tilled plots which were cultivated for the fifth time.

Control of Weeds on Fallow by Chemicals - Aasheim, Havre, Montana.-"Fall spraying and blading of stubble was completed during the month and yields from the various treatments summarized. The following table is a summary of yields of spring wheat on fallow obtained from the various treatments in the chemical fallow project.

Treatment	Bu. per acre
Sprayed with 2,4-D as needed for weed control during 1948	2.9
Sprayed with 2,4-D as needed for weed control during 1948 and sprayed after seeding spring of 1949	2.2
Plowed spring of 1948; 2,4-D used as needed for weed control for balance of fallow period	3.1
Subtilled spring of 1948; 2,4-D used as needed for weed control for balance of fallow period	3.8
Sprayed with 2,4-D spring of 1948; subtilled as needed for weed control for balance of fallow period	7.9
Sprayed with Dinitro spring of 1948; subtilled as needed for weed control for balance of fallow period	7.3
Sprayed with 2,4-D spring of 1948; subtilled as needed for weed control for balance of fallow period and sprayed after seeding spring of 1949	7.0
Ordinary sub-tilled fallow	7.5
Idle land - no weed control during fallow period	1.9

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experiment Watershed, Coshocton, Ohio. - "Although there was a rain of 2.58 inches in August, only 0.33 inch fell in the first 26 days. In fact, for 30 days prior to August 27, only 0.72 inch of rainfall was recorded. In normal growing weather about 6 inches of water would be required for corn in this period.

"Much of the corn has shown signs of moisture deficiencies. A striking example of the effect of topsoil on soil moisture and corn wilting showed up about the middle of the month. In one cornfield, plants in a small area had seriously wilted, whereas a few feet away, the corn plants remained green and alive. There was enough plant food but the subsoil could not hold enough water for corn.

<u>Areas</u>	<u>Water in 7 inches of soil</u>
No topsoil, corn plants wilted	0.29 inch
7" of topsoil, corn plants green (wilting point at about 0.35 inch of water in 7 inches of soil)	.76 inch
Both areas supported a good growth of alfalfa-grass mixture before the corn.	

"Mr. F. R. Dreibelbis reports that soil moisture in the mulch corn plots remained higher than in the plowed corn plots (table 1, columns 4-5 and 8-9). At the end of the month, mulch corn was in general greener than that in the plowed areas.

"Another feature of table 1 is the contrast between soil moisture data in columns 2-3 and 4-5. Columns 2-3 shows soil moisture in sub-tilled and deep fertilized areas. These values are greater than those in the areas which were not subtilled nor deep fertilized.

"Rainwater penetrated to greater depths on the mulch and subsoiled corn watershed No. 127 than on the conventional-plow corn watershed No. 123 (table 2). Soil in both areas had become very dry by August 22. Rains of 2.34 inches prior to September 1, wet up the soil in No. 123 to a depth of 5 inches, whereas, in No. 127 moisture increases were noticeable down to 14 inches. Tables on next page.

"Contour fences (steel posts) on radii of 922, 490, 450, 221, and 113 feet are all looking good. Measurements of tension and post deflection show no failures nor any serious changes. Some sections of fence on the curve have been under observation for two winters and two summers. Some of the DON'TS in construction of curved fences are:

"DON'T have too much pull on any one post. Line them in by eye evenly around the curve.

"DON'T keep the same spacing of posts when the curvature changes. Shorten the spacing of posts as the curve sharpens (radius decreases).

"DON'T stretch the curved fence too tight. The shorter the radius - the less tension in the fence."

Table 1.--Inches water in topsoil (0-7") and upper subsoil (7-10") using subsoil tillage and no subsoil tillage on plowed and mulch plots, 1949

Date	Plowed				Mulch			
	Subsoil tillage		No subsoil tillage		Subsoil tillage		No subsoil tillage	
	0-7"	7-10"	0-7"	7-10"	0-7"	7-10"	0-7"	7-10"
7-11	2.77	1.34	2.49	1.11	3.04	1.34	2.55	1.35
7-14	2.27	1.00	1.63	.89	2.18	1.02	2.08	1.12
7-20	1.89	.94	1.37	.74	1.87	.84	1.85	.97
7/26	2.54	1.10	1.57	.74	2.58	1.12	2.41	1.20
8-1	1.80	.84	1.02	.61	1.90	.80	1.96	.98
8-5	1.42	.74	.82	.66	1.25	.72	1.63	.86
8-16	.82	.53	.76	.52	.82	.53	.89	.55
8-23	.62	.52	.56	.49	.70	.51	.97	.59
8-29	1.03	.51	.75	.48	1.10	.50	.92	.53
9-1	2.25	.85	1.29	.65	1.78	.49	1.57	.69
	1	2	3	4	5	6	7	8

Note: Subsoiling consisted of chiseling to a depth of 12-14 inches and placement of 1 ton lime and 100 pounds of 3-12-12 fertilizer to this depth. Chiseling and fertilizer in bands on the contour at 2-foot intervals.

Table 2.--Soil moisture in plowed and mulch watersheds prior to and after storm periods in late August 1949

Soil depth	August 22		September 1	
	Wd. 123 ¹ /	Wd. 127 ² /	Wd. 123 ¹ /	Wd. 127 ² /
Inches	% Vol.	% Vol.	% Vol.	% Vol.
0-1	8.6	7.1	31.4	32.8
1-3	9.2	10.3	29.7	32.3
3-5	10.0	11.0	30.4	33.0
5-7	11.4	10.0	11.7	28.0
7-10	16.7	18.2	17.3	32.6
10-14	17.3	17.0	21.3	31.1

¹/ Keene silt loam, plowed on contour.

²/ Keene silt loam, mulch culture with subsoil tillage and 2,4-D weed control.

Precipitation 8-22 to 9-1 (Y103)

	Inches
August 27	0.16
28	.47
29	.05
30	.46
31	1.20
	2.34

Hydrologic Studies - John A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"In July we received 2.91 inches of rain and in August only 1.16 inches at the meteorological station. Both months were below normal for the long-time average, with August 1.8 inches below. Accumulated rainfall to August 31, was still 3.5 inches above normal, since the first of the year.

"It has been said that in the Great Plains we can expect two things--at least one 2-inch rain and a drought some time during the year. This year has been no exception. Storing of excess water in the ground during wet periods for periods of drought is a problem.

"Insects have been extremely bad during the late spring and summer. Grasshoppers have been a serious threat in the years past, but this is the first year that green Aphis have damaged large areas of small grains in this section of the country. Oats that had been planted on the contour and in stubble mulch remained greener longer than oats planted in straight rows and it was during this period that the green bugs or green Aphis were in the greatest multitude. Oats yields in the small watersheds varied, however, wheat watersheds where oats were substituted showed less damage than watersheds in the regular oat rotation. An average of all the small grain watersheds showed straight row oats yield as 9.9 bushels per acre, contoured 7.0 bushels per acre, and subtilled as 6.1 bushels per acre. This is just the reverse of previous yields during the past few years and had it not been for the green bugs yields this year would have definitely favored contouring and subtillage."

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Texas.-"Precipitation for the month of August at meteorological station totaled 1.59 inches compared to a normal of 2.33 inches. Following the heavy rains of the last half of June and July there has been sufficient moisture for all field crops and a severe excess for cotton. At the end of the month pastures were quite dry, but other field areas had sufficient moisture. There has been severe damage to cotton crop throughout the Government-owned land due to the excessive moisture. Root rot damage is severe in all areas but particularly severe in those areas where clover crops have not been used as green manure. Angular leaf spot has severely damaged cotton, particularly where the growth of the cotton plants has been rank. In some areas there has been considerable insect damage.

"The cotton root rot has caused considerable damage to the cotton crop throughout the Blackland area of Texas this season. A comparison by fields of the amount of damage on the Y and W watershed areas with different cropping systems showed a much higher percentage of damage in the W area than in the Y area, the difference being attributed mainly to the difference in the cropping treatment on the two areas during the past 10 years. The W area has had the conventional cropping system of the area with 50 percent planted to cotton each year in a cotton-corn-oat rotation; whereas the Y area has had only one-third of the area in cotton each year in a cotton-corn-oat rotation with Hubam clover seeded in the oats and turned under as a green manure crop following oat harvest preceding the cotton year.

"A field and row count of dead and living plants made the last of the month showed only 29 percent of the cotton plants dead in the Y area in comparison to 48 percent of dead plants in the W area--a difference of 26 percent in favor of the Y area. This difference in dead and live plants will undoubtedly affect the

cotton yields from the two areas in about the same proportion. A comparison of cotton yields from the two areas will be made as soon as the harvest is completed."

Hydrologic Studies - G. A. Crabb, Jr., East Lansing, Michigan.--"As measured by the U. S. W. B. type of non-recording rain gage, the precipitation amounted to 2.80 inches at the cultivated watersheds, 2.06 inches at the wooded watersheds, and 2.93 inches at the stubble-mulch plots. These amounts are approximately 99 percent, 73 percent, and 104 percent of the 50-year average August precipitation of 2.82 inches. Precipitation for the month of August, at the cultivated watersheds can be expected to equal or exceed 2.80 inches once in 2.3 years. Cumulative rainfall for the year is approximately 127 percent of normal.

"On August 19 a meeting of the Project Advisory Committee of Experiment Station personnel was held for the purpose of discussing the tentative place for continuation of certain of the studies started by the Benton Harbor project for study of soil moisture conditions under varied types of orchard management. It was decided that members of the Research Station, Extension Division, and Project staffs would, with the help of certain graduate assistants, continue a large part of the work at the O. K. Klett orchard, near Hartford, Mich., and at the S. A. Wark orchard near South Haven, Mich. These orchards offer opportunity to study fertilizer, irrigation, and cover managements, and their effect on soil moisture conditions under apples, plums, and cherries. During the week of August 22 a large number of moisture blocks were installed in these two orchards. It is planned to make regular weekly readings of these blocks, as well as other studies. These studies will be under the active administration and supervision of Drs. L. M. Turk and A. L. Kenworthy, and the project supervisor. A portion of a grant-in-aid to the Experiment Station from the Coke Oven Ammonia Research Foundation is being used to partially defray some of the expenses of making these readings."

Hydrologic Studies - J. H. Thorton, Auburn, Ala.--"The monthly rainfall of 1.50 inches represents 32 percent of the 68-year-average rainfall of 4.76 inches for Auburn. Most of the rainfall came from thunderstorm activity.

"The amount of rain that fell during any one thundershower was generally so small that it did not add materially to the water supply of the plants. The corn crop on the 15- and 20-percent-slope plots is almost matured. The cotton on the 2-, 5-, and 10-percent-slope plots is opening.

"We made degree of aggregation, moisture equivalent, and pore space determinations on the Cecil clay soil, on which the effect of tillage and residue management is being studied in connection with soil physical conditions.

"The moisture equivalent for Cecil clay soil for five months was found to be as shown in table 1 on the next page.

"Tests were run by Mr. Bowden on Decatur and Norfolk soils in pilot plots, 3 feet wide and 7 feet long. The slope of the plot was 5 percent, as both of these soils occur naturally in the field at this slope. Water was applied from type-G nozzles in a pattern of a high intensity for the first 10 minutes and a lower intensity for the following 40 minutes of the run.

Table 1.---Moisture equivalent determinations on Cecil clay soil

Plot	Crop	Kind of Residue	Amount of residue lb. dry wt.	Seedbed preparation	Moisture equivalent*				
					April** 7	May 20	June 20	July 26	August 22
1A	Cotton	Check plot	none	Spading	28.4	26.4	25.6	26.7	28.0
1B	Cotton	Check plot	none	Rototilling	28.4	28.1	25.6	27.1	27.2
2A	Cotton	Cotton stalks mulch	2,000	Spading	28.2	23.5	26.6	27.3	27.6
2B	Cotton	Cotton stalks mulch	2,000	Rototilling	28.2	28.0	26.1	26.9	27.5
3A	Cotton	Cotton stalks turned under	2,000	Spading	28.3	27.4	24.4	27.2	27.6
3B	Cotton	Cotton stalks turned under	2,000	Rototilling	28.3	28.7	25.3	27.1	27.4
4A	Cotton	Succulent blue lupine mulch	2,000	Spading	28.1	28.3	25.4	26.9	27.5
4B	Cotton	Succulent blue lupine mulch	2,000	Rototilling	28.1	28.2	25.3	26.8	27.1
5A	Cotton	Succulent blue lupine turned under	2,000	Spading	28.0	26.8	23.4	25.7	27.0
5B	Cotton	Succulent blue lupine turned under	2,000	Rototilling	28.0	26.8	24.8	26.2	25.9
6A	Cotton	Dried blue lupine mulch	2,000	Spading	28.2	27.8	26.5	28.5	27.9
6B	Cotton	Dried blue lupine mulch	2,000	Rototilling	28.2	27.5	26.0	26.4	27.3
7A	Cotton	Dried blue lupine turned under	2,000	Spading	27.8	27.4	26.5	27.9	27.2
7B	Cotton	Dried blue lupine turned under	2,000	Rototilling	27.8	26.9	24.7	26.8	27.2

*Average of two runs

**April - no residues on any plots

"The moisture content of the soils were "air dry" and "field capacity" for one run on each soil. The "air dry" condition was reached by placing the pilot plot outside in the atmosphere to dry. Previously the soil was sieved through a 1/4-inch screen when put into the pilot plot, so the surface condition at the time of a run was smooth and flat. When the moisture curve flattened out at the low moisture portion of the curve the soil was assumed to be "air dry." After the test was run at the low moisture condition, a cover was placed over the top of the pilot plot, and the plot was allowed to drain overnight. The following day the soil was assumed to be at "field capacity" condition. This procedure is designed to assimilate the condition of getting this type rain following a rain the previous day. The results obtained are found in the following tables.

Soil type	Initial Moisture %	High intensity in./hr.	Low intensity in./hr.	Time "f" is satisfied	Time runoff started	Time "V _d " is satisfied
Norfolk	1.08	3.68	0.67	7'-20" ^a	8'-30"	^c
Decatur	7.02	3.73	.66	3'-15" ^b	6'-10"	13'-0" ^d
Norfolk	12.13	3.79	.82	0'-25"	0'-40"	0'-37"
Decatur	21.19	3.70	.70	0'- 8"	0'-33"	0'-31"

Soil type	Initial moisture %	Soil loss during high intensity lb./acre	Soil loss during low intensity lb./acre	Total soil loss lb./acre	Runoff, % of rainfall
Norfolk	1.08	45.95	5.17	51.12	3
Decatur	7.02	151.29	42.80	194.09	18
Norfolk	12.13	1,983.70	94.92	2,079.01	64
Decatur	21.19	617.80	92.77	711.57	75

- a. - "f" satisfied from 7'-20" to 10'-0", when high intensity was turned off and low intensity was turned on. "f" was not satisfied after 10'-0".
- b. - "f" not satisfied at 11'-0", but was satisfied again at 17'-0".
- c. - "V_d" not satisfied during any part of run.
- d. - "V_d" is satisfied on about half of plot at this time, and remained this way throughout run.

"The time "f" is the time for the slick surface to appear, at which time the infiltration has reached its capacity. The time "V_d" is the time for the depressions or the pocket storages caused by the falling raindrops to become filled with water."

Hydrologic Studies - T. W. Edminster, Blacksburg, Virginia. - "A conference was held with Dr. R. E. Blaser concerning the proposed plans for the pasture research program at the Middleburg Pasture Experiment Station which was recently established through a gift by Mr. Mellon. There is a possibility that suitable pasture watershed studies could be established on this farm with the Experiment Station personnel serving as observers in maintaining the rainfall and runoff recording equipment. This proposal together with the possibility of similar installations on the former Army Remount Station at Front Royal will be more thoroughly investigated during the coming months.

"Mr. Kirkpatrick and Mr. Holtan indicated in the project's report for July a method of analyses which was called "Depth-Discharge Relationship of Flow Applied to Yarnell's Rainfall Data." Considerable difficulties in the application of this method were encountered. It appears that the depth-discharge relationship and subsequently the peak rate of runoff is very very sensitive to detailed characteristics of the watershed. This sensitivity increases as the watershed size decreases. Erratic behavior of peak rates and also of the depth-discharge curves demands detailed information of the watershed characteristics which is beyond practicability; i. e., a flood plane near the weir plays havoc with the peak rate; changes in alignment of the channel does the same. Not only is the peak rate and the depth-discharge curve affected by such characteristics but even the time of concentration, that is, the period of rainfall causing various rates fluctuates because of that.

"In an effort to avoid or explain such erratic behavior, increments of runoff comparable to Yarnell's time increments of rainfall are to be studied. This calls for reworking all of the rainfall and runoff data in the files. Most of the month was devoted to this effort. What little analyses has been placed on these reworked data are very encouraging. They imply that more information concerning the hydrograph lies in instantaneous peak rates."

Farm Ponds - T. W. Edminster, Blacksburg, Virginia. Mr. Holtan spoke to the Wildlife Section of the Virginia Institute of Rural Affairs concerning critical engineering factors in farm pond construction. The final draft of the paper on farm pond sealing for publication in the Agricultural Engineering Journal has been corrected and submitted to the Secretary's office. A paper dealing with engineering responsibilities in the farm pond program was prepared and cleared for presentation at the North Atlantic Section of the ASAE to be held at State College, Pa., the first week in September."

Runoff Studies - N. E. Minshall, Madison, Wisconsin. "Precipitation at Fennimore was 2.39 inches. All of it occurred as scattered light showers, and there was no surface runoff. The ground was quite dry at the end of the month, with considerable evidence of cracking. Temperatures varied from a maximum of 94 degrees on August 7, to a minimum of 45 degrees on August 31, with a mean of 71 degrees, or near normal.

"Precipitation at Edwardsville for the month was 2.89 inches, of which 2.29 occurred on August 2. The maximum intensities for the August 2 storm are as follows: 5 minutes - 4.20; 10 minutes - 3.90, 15 minutes - 3.36, 30 minutes - 2.10, 60 minutes - 1.60. Maximum rates of runoff for this storm were: W-I, cultivated 0.97 inch per hour; W-II, pasture, 0.38 inch per hour; W-IV, 0.32 inch per hour. The total runoff for this storm on the cultivated watershed W-I was 0.80 inch. Temperatures were near normal, with a maximum of 95 degrees on 3 days, and a minimum of 50 degrees on the 22d of August.

"Precipitation at Colby was 2.45 inches. Surface runoff amounted to 0.04 inch and occurred as the result of 0.95 inch of rainfall in 20 minutes on August 10. From the hydrographs obtained thus far, this area appears to produce a double peak from a single intense shower. Somewhat the same condition exists on a larger area at Fennimore in cases of moderate intensities, whereas the heavier showers produce a single peak."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.- "The work of reporting the results of the Whiting Naval Air Station model studies was carried forward during the month of August.

"Miss Dekko completed the typing and assembly of the report covering the tests of a straight drop spillway. A Morris-Johnson type stilling basin was originally proposed for use in one of the ditches at Whiting Field. There are at present a large number of Morris-Johnson stilling basins at use at Whiting Field that have undermined and which require continuous maintenance. This made it highly desirable that the proposed stilling basin design be checked in the Hydraulic Laboratory. The tests showed that deep scour and possible undermining of the structure could be expected. Greatly increasing the tailwater level reduced this scour somewhat, but it was still considered excessive. As a result of these findings, tests of a Wisconsin-type stilling basin were requested. This stilling basin was designed after Kessler. The observed scour at the end of this stilling basin was so deep that it exposed the floor of the test channel. Mr. Donnelly then made a number of radical changes in the arrangement of the sills and baffle piers in the stilling basin, and a design was eventually developed that proved highly satisfactory. The design consists of a single row of baffle piers and an end sill.

"The great improvement in the performance of the stilling basin and the large reduction of scour obtained by the substitution of baffle piers for the sill used in the Wisconsin-type design has been positively shown by these studies. We have demonstrated this action to several engineering training conferences with great effectiveness. It appears that additional work is badly needed to expand these specific results to a point where a generalized design can be developed. Many straight drop spillways are being used in the districts and the flood control program, yet the only general stilling basin design available is the Morris-Johnson type, which tests here have shown to be of questionable value. Copies of the report on the Whiting Field studies have been sent to the Washington offices of Research and Operations Engineering as well as to each of the Regional Engineering Divisions."

Supplemental Irrigation Studies - J. R. Carreker, Athens, Georgia.- "The atmosphere was generally hot and humid during August. Rain fell on 13 days, but only in light showers. The total rainfall was 4.52 inches, or only 0.06 less than the long-time average of 4.58 inches.

"The rainfall and irrigation records by dates appear on the next page.

"The showers during the first and second weeks never wet the ground enough to stop the irrigations. They illustrate the risks a farmer sometimes runs while waiting for rain when showers were forecast repeatedly over a period of several days.

"The insecticide application using Rothone (DDD) through the irrigation system on July 29 did not prove successful. Earworms were as bad in the treated corn as in the untreated area. Apparently this one application was not sufficient or the insecticide was diluted too much in the irrigation water to be effective."

Date	Irrigation crop	Inches	Rainfall Inches
August 1	Vegetables	1.5	
August 2	Pasture (permanent) #1	2.0	0.13
August 3	Pasture (permanent) #2	2.0	.13
August 4	Corn (Block III)	1.5	.01
August 4	Corn (Furrows)	2.3	
August 5	Corn (Block IV)	1.5	
August 8			.12
August 10	Corn (Block II)	1.5	
August 11	Pasture (supplemental)	1.0	
August 14			.27
August 16	Pasture (supplemental)	1.0	
August 17			.79
August 19			.25
August 20			.61
August 21			.29
August 27			.80
August 28			.57
August 30			.40
August 31			.15
		Total -	4.52

Drainage Studies - T. W. Edminster, Blacksburg, Va.--"During August Mr. Phelps Walker, Drainage Engineer, visited eastern Virginia to investigate the draw hole that was noted on the quick-sand study. Despite bad weather and high water-table conditions, the main on the Lee farm was opened August 3 through August 5. It appeared that the draw hole was caused by a 1-1/2-inch space on either end of one joint of the 6-inch tile main. The paper covering over the tile joint had broken thus permitting soil, corn stalks, and other foreign material to enter and choke the main. Unquestionably, the failure of the tile system was due to faulty installation of the tile main. There appears to have been two possible explanations. In the first case the caving of the ditch banks immediately behind the ditching machine necessitated placing the tile and covering the joints with paper while the new tile joint was still between the shields of the machine. Since there is considerable tendency for the clay tile to adhere to the sandy layer in the bottom of the ditch, it was sometimes very difficult to properly place the tile with a minimum of crack remaining between the two tile joints. It is possible that this adherence caused the joint of tile in question to be improperly placed and since the tile joint was immediately covered with a continuous strip of paper fed from a spool mounted between the shields of the machine, it was impossible to inspect the fit of the individual joints as carefully as can be done under normal tile placement conditions.

"The second possible cause for failure might be based on observations that have been made by several of the Virginia technicians and engineers. They have noted that there is considerable adhesion between the shoe of the ditching machine and the surface of this particular soil. This adhesion between the moving shoe and the soil apparently transmits sufficient force to move forward the layer of soil upon which the tile is being placed. It appears that these quick-sand soils have the necessary properties to exhibit a rather high adhesive and cohesive strength even under conditions of near saturation. Considering the textural nature of the

soil, this is a somewhat surprising observation. This forward movement of the soil following the advance of the trencher shoe has been observed to move a tile forward and out of its original point of placement. When the tile joints are being covered by a continuous paper strip, this movement of the tile is sometimes unseen, with a resulting wide space being left between the two tile joints. It is possible that the failure in the main could have been caused by either of these two factors.

"Mr. Walker indicates that he saw nothing to suggest that the tile had moved in the soil after construction was completed. The floor of the ditch beneath the tile was firm and the print of the strengthening bar beneath the shoe of the ditching machine could still be felt in the soil beneath the tile.

"It was necessary to open the main at several other points below the draw hole. No trace of foreign material was found in the main except at the point where the tile was choked. At all points, the main contained approximately 4-1/2 inches of sedimentary material. This material appeared to have come only from the quicksand layer of the profile. Thru use of a sewer tape, it appeared that this condition extended over most of the 750 feet of 6-inch main.

"Two laterals were opened at the same time as the main. They, too, were almost full of sediment.

"The portion of the peanut crop lying above the point that the main was clogged was almost dead from excessive water. Other places in the field were "yellowing."

Drainage Studies - J. C. Stephens, West Palm Beach, Florida.-"Rainfall in the Everglades was sub-normal for the first three-quarters of the month and the water table slowly fell until August 26 when a tropical hurricane traversed the northern portion of the project area bringing heavy rainfall.

"This storm originated in the Caribbean and traveled in a general northeasterly direction. The center of the hurricane entered the Florida peninsular just south of West Palm Beach near Lake Worth and then went across the 'Glades to Port Mayaca and across Lake Okeechobee, emerging near the entrance of the Kissimmee River. It then crossed the sand prairie lands to the hills near Lake Placid and thence through Bartow, leaving the State near Cedar Key. The strongest winds and heaviest rainfall occurred to the north and east of the storm's "eye." The West Palm Beach area and the Pahokee area suffered considerable property damage, and the citrus belt also lost heavily. Fortunately there were few casualties. The wind at West Palm Beach and Stuart exceeded 150 m. p. h., while at Ft. Lauderdale it was only 75 to 100 m. p. h. The rainfall to the northeast of the storm ranged from 6 to 10 inches, while to the southwest it was generally under 5 inches. Pompano received about 7 inches, Fort Lauderdale about 3-1/2 inches, and Miami from 1 to 2 inches. In crossing Lake Okeechobee there was considerable wind tide and the existence of the Federal levees undoubtedly prevented heavy casualties in that area. The Lake level was approximately 13.2 ft. m. s. l. prior to the storm. At the eastern shore the water level dropped to an elevation of 5 feet at the beginning of the blow, and then mounted to above an elevation of 22 feet when the wind changed directions. At places along the levee where there were no fore-shore plantings and little vegetation the levee itself was eroded, but no breaks occurred. This damage was estimated at \$300,000. Ironically, water hyacinths, long considered

a pest, were a factor in reducing the damage to the levee as they were blown against the structure and served to dampen the force of the wave action. The hurricane caused only minor damage to SCS equipment.

"As a result of storm rainfall, Lake Okeechobee rose to an elevation of 14.6 feet m. s. l. at the end of the month. The rainfall at the Everglades Experiment Station during August was 11.67 inches of which 8.18 inches were recorded for the storm on the 27th and 28th. A total of 6.74 inches occurred on the 27th, and 1.44 inches on the 28th. Evaporation from the standard pan was 6.10 inches for the month. The mean maximum temperature was 90.5 degrees and the mean minimum temperature was 70.5 degrees.

"Results of the survey made along the Cross Canal near Belle Glade the latter part of July to determine the change in the channel cross section since 1940 were compiled. There is a slight increase in the top width of the canal due to sloughing of the banks, but the total area has been reduced appreciably due to bottom deposits of sludge. The area below bank-full stage in 1949 was only 393 square feet as against 476 square feet in 1940, and the hydraulic radius was 5.86 feet as against 7.14 feet. Thus the water-carrying capacity as determined by the boundary geometry of the channel was materially reduced. The value $AR^{2/3}$ of the channel being 1,277 in 1949 compared with 1,765 in 1940, or a reduction of approximately 40 percent in 9 years. It is planned to make a similar study on the North New River Canal where the flow velocity is somewhat higher than in the Cross canal this coming month.

"Flow measurements to determine the values of "n" for typical canals in the area were continued. On the Osborne farm lateral near Fort Lauderdale considerable underwater aquatic growth of moss was noted to have taken place since the original tests were made the first part of June this year. These first tests were made directly after the channel had been dredged, and the resulting values of "n" were found to be approximately 0.055, as reported in June. On August 29 it appeared that the channel was filled with mosses to about 50 or 75 percent at the water-level stage then existing. Flow was observed at the surface and the velocity appeared comparable to the early tests. Moss was cleaned by hand for a distance of about 10 feet in both directions from the upper and lower measuring sections, but none from within the slope-course reach. Since the vertical velocity distribution was doubtful the average velocity for the vertical was determined by the formula $\frac{\text{Bottom Velocity} + 2(\text{mid-depth vel.}) + \text{Top vel.}}{4}$. During the course of the flow measurement it was found there was no measurable flow at the bottom, in most cases little or no flow at mid-depth, and that practically the total flow occurred near the surface above the top of the mosses. Results of this test are shown in table 1, together with earlier results made when the channel was clear for comparison. The extremely high values of "n" determined in this test (Manning's $n' = 0.676$ and Kutter's $n = 0.586$) show these retardance coefficients have been increased by the aquatic mosses over a period of 73 days by over 10 times the original values. It is not certain that the value of "n" obtained will necessarily hold true for higher stages and faster velocities as there will probably be a tendency to depress the mosses to a greater depth and free more of the channel area for flow. None the less, these results show that the underwater mosses are probably the most serious problem, not excepting water hyacinths, in maintaining adequate channel capacities in this area. Since the intensity of light that reaches the canal bottom appears to be a prime factor in the growth of such mosses it may

Table 1.--Results of experiments in the Everglades area, Main farm lateral in Osborne's Grove on North New River Canal near Davie, Fla., length of reach tested, 1,000 feet

Date of observation	Average maximum depth	Average surface width	Flow sec. ft.	Average X-sec-area sq. ft.	Mean velocity ft.-sec.	Mean hydraulic radius	Slope ft.-ft.	Coefficients			Elevation-bank Full stage	Elevation-water surface	Elevation of bottom
								Chezy c	Mann- ing n'	Kutter n			
6/16/49	3.6	17.6	7.75	47.55	0.163	2.34	0.0000145	27.98	0.0614	0.0558	6.50	5.02	1.4
6/22/49	4.1	18.4	11.16	57.17	.195	2.61	.0000118	31.11	.0497	.0466	6.50	5.58	1.4
8/29/49	3.2	16.4	2.32	39.49	.0536	2.09	.000265	2.49	.676	.586	6.50	4.56	1.4

Ditch blasted into lime rock and material excavated by dragline. Course: straight. Cross Section: little variation in shape. Side slopes and lower 2/3 of ditch quite irregular due to vertical solution holes in Miami oolite limestone. Upper 1/3 fairly regular. Bottom: silt in bottom of ditch smooths out irregularities left during construction. Soil: lower 2/3 Miami Oolite limestone with many vertical solution holes from 6 to 24 inches in diameter. Upper 1/3 Everglades Peat with a layer of sand about 8 inches thick lying between top of rock and peat. Condition: Ditch cleaned by dragline from west bank about 2 weeks prior to test. A little vegetation on upper part of east bank, west bank clean. No water grasses. In general, this ditch was in as good shape as feasible to put it by using dragline for maintenance.

8/29/49 Description remains the same as above except for condition. Channel heavily infested with dense growth of aquatic moss.

Table 1. Farm lateral with mole drains in section 10, Everglades Experiment Station, Belle Glade, Fla.
length of reach tested: 1,000 feet

Part 2

Date of Observation	Average maximum depth	Average surface width	Flow sec. ft.	Average X- Sec. area sq. ft.	Mean velocity ft. sec.	Mean hydraulic radius	Slope ft.-ft.	Coefficients			Elevation bank ft.	Elevation water surface ft.	Elevation of bottom ft.
								Chezy C	Manning n'	Kutter n			
3/31/49	1.0	4.4	0.769	4.19	0.184	0.717	0.000572	9.09	0.155	0.108	14.1	11.67	10.7
2/49	1.0	4.4	.750	4.19	.179	.717	.000552	8.99	.156	.109	14.1	11.68	10.7

Ditch excavated by dragline. Course: straight. Cross section: little variation in shape.
Bottom: Smooth except for occasional clumps of material which have fallen into ditch.
Soil: Everglades Peat. Condition: some growth of pigweed roots and stalks along upper part of banks. Water hyacinths cover water surface approximately 35 percent of reach.

be that the problem will be less severe in deeper canals carrying turbid water. Since the growth is one of our worst problems, plans have been made to make experiments with certain chemicals to determine their efficiency and economy as well as their growth inhibiting properties on the under water growth. Also it is hoped to establish additional slope courses on some of the deeper and larger canals such as the Tamiami where these mosses are prevalent, to determine the value of "n" under such conditions.

"A 1,000-foot slope course was established in section 10 at the Everglades Experiment Station on a farm ditch approximately 3-1/2 feet deep, at bank-full stage, with a bottom width of 4 feet, and top width of 6 feet. This ditch is intercepted by mole drains at intervals of approximately 25 feet. It was originally cross sectioned about August 6, and no flow occurred until after the storm of the 27th. Two flow measurements were made afterward, on the 31st. and on September 2. It was found at this time that the original ditch depths had been altered to the extent that a new survey was needed, which was made September 2. The results of these two runs are shown in part 2 of table 1. It should be noted that the stages at the time were quite low and that there was considerable hyacinth growth in the ditch, Table 1 appears on the previous page.

"The accuracy of the use of dye to determine flow velocity was made by timing the movement rate of a solution of Congo red injected into the stream over a 50-foot measured course, as compared to velocity obtained using the current meter. The velocity obtained by the use of the dye was about 10 percent lower than that determined by meter. The dye method was not satisfactory due to difficulty in estimating the beginning and ending of color trace passing the reference line at the end of the reach. It also appears that the color disappears rather rapidly in water containing suspended organic matter, possibly due to an oxidizing effect. Perhaps other types of dyes would prove more satisfactory under these conditions."

Drainage Studies - M. H. Gallatin, Homestead, Florida. - "Though rainfall was distributed quite uniformly over the period for the most part the precipitation was light. Rains or showers were recorded 20 days during the period. The greatest number of showers occurred in the coastal area south of Florida City where rains occurred 20 days, and the fewest at the gage on west Mowry where rains occurred only 10 days during the period.

"Rains of an inch or over occurred on the following dates at our various gage locations:

8/10	gages 1, 2, 6, 7, 11
8/18	E-33
8/27	Gages 5, 8, 9, 10
8/24	Gage 5

"The following table gives the totals by months for our gages for the past 4 years.

Location	August 1949	August 1948	August 1947	August 1946
Redland & Mowry	6.08	11.04	10.30	6.96
Sub-Trop	5.31	10.99	11.91	7.61
Redland & Gossman	3.56	10.30	9.51	5.62
Plummer & Comfort	4.72	-----	-----	-----
Peters, Fla.	5.06	5.68	6.62	8.78
Princeton	5.42	7.89	8.06	4.93
Cooper	5.99	8.68	7.05	3.75
W. Mowry	5.45	11.30	9.11	-----
E-33	5.25	8.64	5.95	-----
Roberst & Avocado	5.47	11.74	10.55	7.92
Jeran	4.52	-----	-----	-----
Country Cl & Waldin	4.10	-----	-----	-----
Piowaty Gr*				
E. Glades*				

*New gages set out during August.

"Well readings for the Redland profile from August 1 to August 22, showed losses ranging from 0.14 at Highlands to 0.90 foot at the measuring point. From August 22 to 29 due to heavy precipitation in the southern half of the area we had a gain in our water table ranging from 0.01 to 0.3 foot. For the period losses ranged from 0.05 at Highlands to 1.06 at the measuring point.

"Well readings for the Eureka profile showed a slight recharge toward the last of the period. Losses ranged from 1.17 in the north central part of the area to 0.69 foot in the coastal area east of Peters, Fla.

"For the Mowry Street profile readings from August 1 to August 22 we had a loss in elevation ranging from 0.35 to 0.71 foot. From August 22 to 29 due to a few heavy showers slight gains ranging from 0.09 at the west end to 0.25 in the coastal area. For the period losses ranged from 0.3 foot in the coastal area to 0.54 at the west end.

"Our reading and rainfall data show that we had heavier and more constant rains in the southern and eastern coastal area during this period.

"The water table is somewhat lower for the area this period than it has been since this study was initiated. On August 31, 1949, the reading at Well #5, corner of Redland and Mowry was 3.90 feet m. s. l. on August 31, 1947, it was 4.80 feet and on August 31, 1946, 4.37 feet.

"There has been a loss in water table in the Everglades area to the north and west to Krome avenue as will be noted below for the readings made July 6 and August 23.

	7/6/49	8/23/49	
Krome & Tamiami Trail	6.21	6.58	plus.37
Bird Road	6.19	6.53	" .34
Staff Gage	6.67	6.12	minus.55
G-25	7.02	6.41	" .61
G-24	7.02	6.30	" .72
G-23	6.68	6.12	" .56

"Rainfall during the month occurred from August 1 to August 12 and from August 26 through August 28. We had a period of 15 days in which only three light showers occurred. Low rainfall coupled with high winds tended to dry out the mulch plot areas very rapidly. From the week of 8/19 to 8/26 readings in the mulch plots, natural cover, and check showed that the moisture had dropped below the wilting point. Losses were not as great for the shavings, pine straw, and grass mulched areas, but there was a definite increase in the readings for this period.

"From the standpoint of conservation of moisture, grass or pine straw are superior to the shavings. It has been noted that there has been a definite increase in the amount of organic matter on the pine and grass mulched areas whereas in the shavings mulched area there has been no accumulation.

"Nitrate samples collected from the mulch plots show that there is very little from the shavings material averaging from 1-3 p. p. m. while for the pine straw and grass mulched areas, nitrates have ranged from 17 to 32 p. p. m. for the period."

Hydrologic Studies - R. B. Hickok, LaFayette, Ind.-"Wheat samples harvested in July were threshed and weighed. The wheat yields on the conservation treated watersheds were the highest for the 6 years of record. However, this year's yields under the 'prevailing' treatment were less than in 1946. The yield difference between treatments was 6 bu./A. that year, compared to over 11 bu./A. difference this year. The average treatment difference for the 6 years is a little over 7 bu./A. The largest difference was 13 bu./A. in 1948.

1949 Wheat Yields¹ from Experimental Watersheds,
Purdue-Throckmorton Farm, LaFayette, Indiana

Treatment	Watershed	Yield (bu./A)
Conservation	2	42
	11	48
	Av.	45
Prevailing	4	33
	12	35
	Av.	34
Treatment Difference		11

¹Estimated from 0.002A. samples at 50' x 50' intervals, 60 lbs./bu. at 13-1/2 % moisture

²Wheat on conservation treated watersheds drilled on contour, with 545 lb./A. 3-12-12, and 50 lbs./A. am.-sulphate top dressing in spring; on prevailing treated watersheds, wheat drilled in straight rows with 160 lb./A. 3-12-12.

"Straw yields averaged 5,040 lbs./A. from the conservation treated watersheds and 3,262 lbs./A. from those under prevailing treatment. Of these gross weights of straw, about 7 percent and 4 percent were estimated to be admixed top growth of meadow seeding mainly timothy for the conservation and prevailing treated watersheds, respectively. The ratios of grain weights to gross straw weights averaged 0.54 for the conservation treated watersheds and 0.62 for those under the prevailing treatment.

"The nutrient compositions of both wheat grain and straw are being analyzed.

"Wheat yields determined for the mulch tillage plots at LaFayette showed no statistically significant residual effects of the eight tillage treatments of the preceding corn crop 2 years before. The lowest yield of 40 bu./A. was where seed bed for corn had been prepared in narrow row strips, with subsequent shallow tillage and meadow residues left on the surface between the corn rows. The highest yield of a little under 46 bu./A., was on plots that had been prepared for the corn crop by shallow mixing of the meadow residues, with shallow tillage, 3 - 4 inches depth.

"Oat yields on the tillage plots at Albion ranged from 53 to 62 bu./A. The lowest yield was from the plots that had been prepared for the previous corn crop with a surface mulch of the meadow residues, but with similar depth of tillage for the preceding corn. But, with the meadow residues mixed through the upper 3-4 inches. Another set of oats plots near Cromwell, yielded from about 64 to 76 bu./A. Again the lowest yields were from plots that had had surface mulches for corn and the highest where the meadow residues had been mixed into the soil in preparing the seed beds for corn (exceeding those plowed in the conventional manner). These data have not been tested for statistical significance.

DIVISION OF IRRIGATION AND WATER CONSERVATION

Irrigation Requirements in Region 6 - Harry F. Blaney, Los Angeles, Calif.-"A report on Consumptive Use and Irrigation Requirements in Colorado was completed. Data on irrigation and water use are given in the report for 46 irrigated areas in the State of Colorado, which should be useful in the farm-planning program of Operations of the Service. Similar information is being collected for Arizona and New Mexico."

Upper Santa Ana Valley - Dean C. Muckel, Pomona, Calif.-"In preparation of soil moisture sampling for fall deficiency, sampling stations were located in company with V. S. Aronovici. The stations were located so as to cover the predominating soil groups and crops. It is planned to start studies in the Bunker Hill, Tialto-Colton, Lytle Creek and Devel Canyon ground-water basins this fall."

San Fernando Valley Investigation - W. W. Donnan, Los Angeles, Calif.-"Most of the month has been spent in field and office work connected with the San Fernando Valley problem. Runoff calculations were made of rainfall storms for the past 20 years in an attempt to determine the significance of runoff in the deep penetration estimates. It has been determined that runoff from the agricultural lands has been small compared to runoff from the other land-use classifications.

G. M. Litz, Los Angeles, Calif.-"The hydrographs of key wells near the high water-table hazard area of western San Fernando Valley showed a continuous rise in water-surface elevations since 1940 to elevations higher than any previously recorded. To determine the extent of this condition, all available hydrographs of wells in the valley west of Balboa Boulevard were obtained. Analysis of the hydrographs showed the rising water-surface condition to be general throughout this portion of the valley, with a tendency to maintain the elevations reached in 1947. Some reason for the condition was found by examination of the pumping records of the wells and the seasonal rainfall records of the valley.

"Since about 1934 more and more wells used for irrigation have been abandoned and irrigation water obtained from the Los Angeles City water mains carrying imported water, and the very few new wells drilled since 1940 have replaced existing wells. This has resulted in decreasing yearly amounts of well water used. In addition, the rainfall year 1936-37 was 133 percent of normal; 1937-38, 138 percent; 1938-39, 120 percent; 1939-40, 95 percent; 1940-41, 224 percent; 1941-42, 75 percent, 1942-43, 138 percent; and 1943-44, 138 percent."

Imperial Valley Investigations - Geo. B. Bradshaw, Imperial, California.-"In May of 1949, a study was initiated to determine the pressures in tile-drainage systems under various irrigation and leaching conditions. The 150-acre test plot was tiled in June of 1948. The soil was light to medium texture and was highly stratified. The drainage system comprised 22,025 feet of tile with a lateral spacing of 300 feet. At the initiation of the study a 2-foot concrete pipe riser was installed at the junction of each of the eight laterals with the base line. These concrete risers were used to obtain pressures in the drainage system during the study.

"During a normal irrigation cycle, of 10 to 15 days, 1 foot of pressure was noted in the system during the second and third days following irrigation. For the remainder of the cycle there was no pressure in the drainage system. This would

indicate that the drainage system was adequate for normal irrigation conditions.

"During a leaching program, ponding of water on the surface for the removal of excess salts, pressures up to 6 feet of head were developed in the drainage system. This pressure condition in the system tends to waterlog the soil and restricts the removal of excess salt between the laterals.

"This and previous studies indicate that a drainage system that is adequate for normal operation of a farm may be underdesigned for a leaching program. Solutions to the problem could be larger designed collecting lines, leaching smaller portions of the farm at one time or using short alternate wetting and drying period to flush out the excess salts."

Friction Losses in Pipes and Fittings - Carl Rohwer, Ft. Collins, Colo.-

"The report on Friction Losses in Valves and Fittings has been approved for publication by the Washington Office and has been submitted to the Colorado Agricultural Experiment Station for publication as a Special Station bulletin. If the Station publishes the report it will be with the understanding that the bulletins will be sold in order to reimburse the Station for the cost of printing."

Silt Studies - Dean W. Bloodgood, Austin, Texas.-"During the month an annual progress silt report on the Silt Load of Texas Streams for 1947-48 was completed and is now in the process of being multilithed. This is the 10th report. It will be ready for free distribution during the early part of September.

"At the present time silt data are obtained at 24 stations, located on 10 of the watersheds of Texas. Since 1899 silt data have been obtained at 45 stations. The complete silt program calls for studies at 74 stations, which include the 45 that have contributed data.

"During the past 25 years to September 30, 1948, a total of 100,508 daily observations have been made and each observation has consisted of one to three water samples. During the year 1947-48, 7,775 daily observations were made at the 24 stations, and 11,062 water samples were received and silt determinations made at our cooperative silt laboratory."

Irrigation Studies - Dean W. Bloodgood, Austin, Texas.-"At Hockley, on the Ray Wood farm, rice was being combined on a 60-acre tract which Mr. Ditto, the operator, estimates will yield an average of about 19 barrels per acre (165 lbs. per barrel). The irrigated area at the farm this year is 300 acres. The pumping plant has been in continuous operation since May 25 and is pumping considerable sand. The pulsation of the pump started soon after pumping commenced this year, while last year it commenced about a month after the pump was started. At the time of my visit the pump was discharging about 1,580 gpm. There has been no precipitation at the farm during the irrigation season, although heavy rainfall occurred in nearby areas."

Management of Related Irrigation and Drainage Enterprises - J. H. Maughan, Logan, Utah.-"The multiple organization of irrigation and drainage enterprises in many parts of the West often results in inefficient enterprise management. Several small competing enterprises in a unit area usually lack the trained leadership, the initiative and strength possessed by a single large enterprise

that is required to solve the irrigation and drainage problems. This failure to solve problems as they arise often results in wasteful use of irrigation water and the development of drainage problems which are the most costly element of an irrigation enterprise.

"In the Cub River Irrigation Company area with 11 irrigation enterprises, all receiving water from a common source, and 6 organized drainage districts, the drainage problem has become chronic. The lack of proper drainage costs the farmers annually 20 percent of their crop production, and 17 organized enterprises have learned to live with this problem rather than solve it.

"The solution undoubtedly lies in the strength and initiative of consolidated organization. The tendency to continue the present organization pattern is due largely to the inability of individual leadership to convince stockholders that present organization is unsatisfactory. Public agencies have the responsibility of assembling specific and reliable information concerning the activities and accomplishments of present-day irrigation company and drainage district activities, and on the basis of these studies, of making recommendations for sound, workable improvements."

Irrigation Studies - Willis C. Barrett, Logan, Utah.- "Analysis of last year's data reveals the following facts: (a) the consumptive-use values used for the Ashley area are about correct for the period of time used, or between frost-free dates. However, the pre-frost and the post-frost consumption of water by alfalfa and pasture are substantial values and must be determined. Arrangements are being made to have the valley observed this fall until growth of these two crops plus that of wild vegetation ceases. Estimates of consumptive use for this period will be made for this year, but it is hoped that two new tanks will be installed for the purpose of getting pasture use with high water table. It will be necessary also to make a careful study of the disposal of winter precipitation. Evaporation during this time is believed to be important.

"The new all aluminum pressure plates appear to be of excellent quality and give promise of a significant advancement in materials and construction of this apparatus.

"Some time has been spent in studying the situation with regard to a soil sampler that will sample well into ground water. The new soil sampler by the Utah Scientific Research Foundation appears to be an excellent tool for sampling soil to the water table. However, it has been shown that in its present form it cannot take out soil below the water table. This leaves the mode of sampling below the water table unsolved except for the Imperial Soil Sampling Tube which could go to about 12 feet below water or the gravel surface. A study is being made to see how this type of tube may be made to go deeper and with minimum power equipment."

9/26/49

